

Analysis of Land Suitability for Woodland Expansion in Scotland: update 2020

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1 Executive summary

The Scottish Government has a statutory commitment to achieve net-zero greenhouse gas emissions (GHG) by 2045. One land use change that will help meet this target is to increase woodland planting. Scotland's Climate Change Plan includes commitments to incrementally increase the annual woodland creation target from 10,000 to 15,000 ha per year by 2024/25 (Scottish Government 2019)^[1].

In 2011 the Woodland Expansion Advisory Group (WEAG) provided detailed analysis of the land area that might be suitable for planting new woodlands (WEAG 2012)^[2]. This report summarises the results of an initial re-analysis of the opportunities and constraints for woodland expansion in Scotland, using a GIS spatial analysis:

- An updated analysis of the land area suitable in principle for woodland creation has increased the estimate by 270,000 hectares to 2.96 million hectares. This means ecologically suitable land, excluding sensitive or unsuitable soils and/or protected areas.
- This is due to changes in peat soil classification and extent (-263,352 ha) and the inclusion of potential planting on higher quality agricultural land (+533,352 ha).

2 Approach and results

The key difference from the previous analysis (WEAG 2011) is that prime agricultural land was no longer excluded in the first step ("Phase 1") of assessing the area potentially suitable for woodland expansion. This new analysis used updated spatial data including existing woodland areas, peat depth maps, areas with conservation designations and catchments at risk of acidification to calculate areas that should be excluded from woodland expansion.

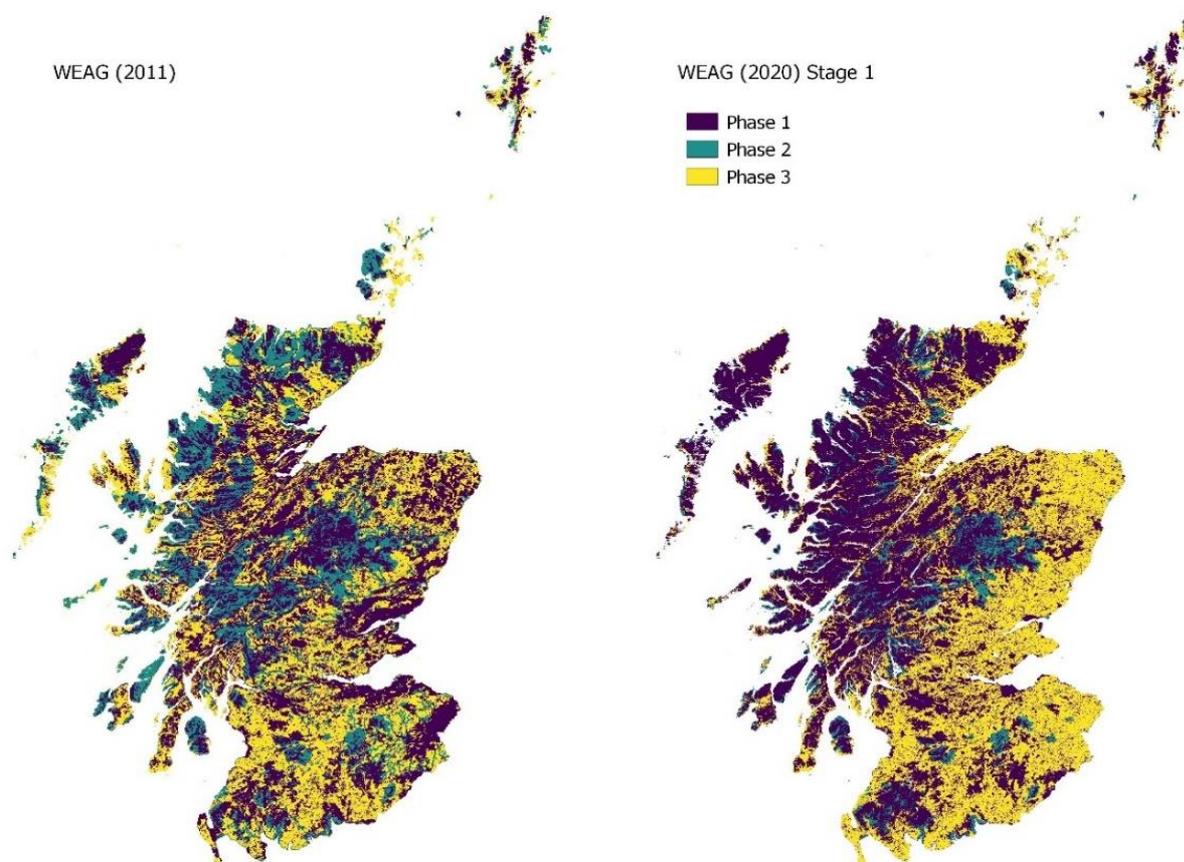
The re-analysis of the original WEAG 2011 approach was based on biological potential (soils and climate constraints) with a filter applied to omit soils with >0.5m depth of organic layer, classed as 'deep peat' in the Forestry Commission soils classification. The resulting estimated area available in principle for woodland expansion was 10% larger (270,000 hectares) than the 2.69 million hectares estimated in WEAG 2011. This is despite new restrictions on available land due primarily to improved mapping of the area of deep peat soils (Appendix A). The estimate of the associated area of each WEAG category (Phases 1-3) is provided in Table 1. A complete list of datasets used is provided in Appendix B.

Table 1. Summary of area in each WEAG category in the 2011 and 2020 analyses.

| WEAG categories | Area (2011) | Area (2020) |
|---|-----------------------|-----------------------|
| Phase 1: Land that is predominantly <u>not</u> available for woodland expansion | 3.59 million hectares | 4.29 million hectares |
| Phase 2: Land that is not in Phase 1 that is affected by conservation designations or in catchments at risk of acidification which impose varying degrees of constraint on woodland expansion | 1.60 million hectares | 0.54 million hectares |
| Phase 3: Land that is not included in the first two categories, i.e. land potentially available for woodland expansion | 2.69 million hectares | 2.96 million hectares |

A comparison of the land area which can be considered for woodland expansion between the WEAG 2011 and this 2020 assessment is provided in Figure 1.

Figure 1. WEAG land availability maps from the 2011 and 2020 analyses.



The area of each Land Capability for Agriculture (LCA) class in each WEAG category (Phase) is shown in Table 2 and confirms that land capability for woodland expansion clearly exists across all broad LCA groups.

It is important to note that different types of land use exist within each broad land capability (LCA) class. Field level management data on current land use, as held in the Integrated Administration and Control System (IACS) database, show that woodlands occur across all LCA classes and, for example, that very small amounts of rough grazing occur on LCA Grade 1 land. For improved grassland, whether rotational grassland or relatively undisturbed improved grassland, substantial areas exist which would be deemed appropriate for woodland expansion.

Table 2. Area estimates of land potentially available for woodland expansion (WEAG Phase 3) grouped by Land Capability for Agriculture classes of maximum agricultural land use potential. Analysis of potential area does not account for likely carbon outcomes.

| LCA Class | Land capability class | 2011 WEAG Area (hectares) | 2020 WEAG Area (hectares) |
|-----------|-----------------------|---------------------------|---------------------------|
| 1.0 – 3.1 | Arable | 0 | 533,352 |
| 3.2 – 4.2 | Mixed Agriculture | 987,318 | 1,150,897 |
| 5.1 – 5.3 | Improved Grassland | 632,915 | 673,771 |
| 6.1 – 7.0 | Rough Grazing | 1,015,487 | 598,505 |

3 Conclusion

The potential to meet Scottish Government Climate Change Plan woodland creation targets will require trees to be integrated into the agricultural landscape. Overall, we find there is sufficient area available which spans the spectrum of land capability classes, from arable land to rough grazing, as defined by the Land Capability for Agriculture mapping units, to meet Scottish Government targets for afforestation.

The key requirement going forward is to fully understand the interaction between soil carbon, forest type and forest carbon sequestration (forest yield) and how the impacts of various afforestation strategies can influence the contribution of new woodland to net-zero ambitions (Matthews et al, 2020).

4 References

Matthews, K, Wardell-Johnson, D, Miller, D, Fitton, N, Jones, E, Bathgate, S, Randle, T, Matthews, R, Smith, P & Perks, M. (2020,). 'Not seeing the carbon for the trees? Why area-based targets for establishing new woodlands can limit or underplay their climate change mitigation benefits', *Land Use Policy* 97 (2020) 104690

Scottish Government (2019) Scotland's Forestry Strategy 2019-29

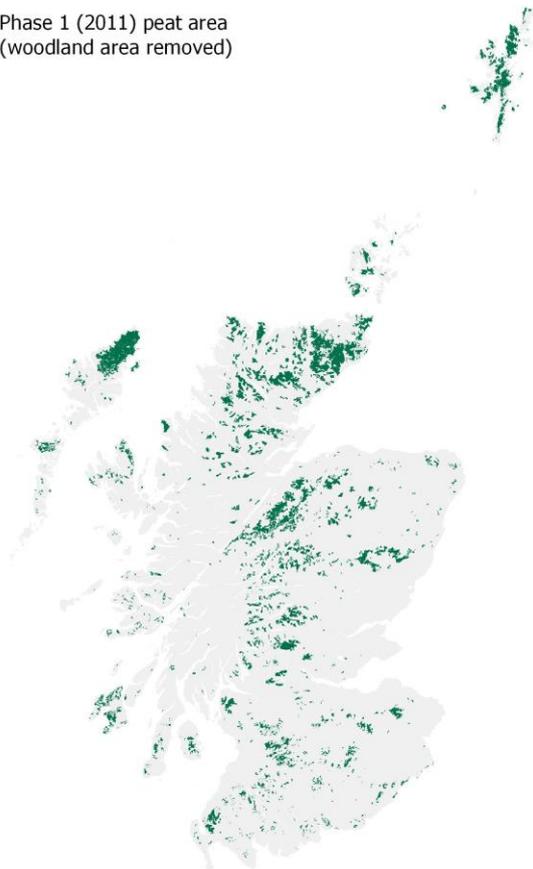
WEAG (2012) Report of the Woodland Expansion Advisory Group:

<https://scotland.forestry.gov.uk/images/corporate/pdf/WEAGFinalReport.pdf>

5 Appendix A

Peat maps used in (a) 2011 analysis and (b) the 2020 re-analysis.

Phase 1 (2011) peat area
(woodland area removed)



Phase 1 (2020) peat area
(woodland area removed)



6 Appendix B

Comparison of data sets used in the 2011 and 2020 (Stage 1) WEAG analyses.

| Category | WEAG 2011 | WEAG 2020 (Stage 1) |
|---------------------------------|---|---|
| Phase 1 | | |
| Woodland extent | NFI 2011; NWSS; new grant schemes | NFI 2018 |
| Biophysical constraints | LCS88, national soil map | LCS88 ¹ |
| Ecological unsuitability | ESC species + NVC | ESC species only |
| Peat | National soil map 100% peat | Peat layer 2019 ² >0.5m depth |
| Land Capability for Agriculture | Classes 1, 2 and 3.1 | n/a |
| Phase 2 | | |
| Conservation designations | SSSI, NNR, NSA, SPA, SAC (2011) | SSSI, NNR, NSA, SPA, SAC (2019) |
| Catchment management | Catchments at risk of acidification (FR 2005) | Catchments at risk of acidification (FR 2019) |
| Heritage sites | Scheduled Monuments and World Heritage Sites | n/a ³ |

¹ Land Cover Scotland Map (1988) was used for consistency with the 2011 and earlier 2005/6 analyses.

² The new peat layer has increased the area of land in Phase 1 compared to the 2011 analysis; much of this land is designated, therefore reducing the area of land in Phase 2 in the 2020 reanalysis. See Appendix B.

³ Due to time constraints these have not been included in the 2020 Stage 1 analysis. The 2011 analysis found them to account for 21,000 hectares.

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